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The Education Papers

Public Investment in Skills:

Are Canadian Governments Doing Enough?

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In this issue...

Skills are important to national economic growth — and Canada does not fare well in international skills comparisons. A comprehensive skills strategy to raise Canadian students' and workers' literacy and numeracy would help.

The Study in Brief

Although Canada is generally recognized to have a good education system, Canadians do not perform well on international tests of literacy and numeracy for adults, particularly when compared to other highly developed countries. While much of the recent policy debate has focused on increased spending to improve public health care, not enough attention is being paid to the equally crucial goal of investing in the literacy and numeracy skills of Canada's population. Finding the right balance between current consumption spending and long-term investment will ultimately determine our level of wealth and our ability to finance public consumption goods in the future.

One of the reasons skills have been neglected could be that economists have had difficulty establishing a strong empirical link between educational attainment and economic growth at the cross-country level. However, recent research shows that using direct measures of skills — such as those provided by the International Adult Literacy Survey — rather than educational attainment produces a clear relationship between investments in human capital and both long-run economic growth and long-run labour productivity. Specifically, a country's literacy scores rising by one percent relative to the international average is associated with an eventual 2.5 percent relative rise in labour productivity and a 1.5 percent rise in GDP per head. These effects are three times as great as for investment in physical capital. Moreover, the results indicate that raising literacy and numeracy for people at the bottom of the skills distribution is more important to economic growth than producing more highly skilled graduates.

These findings have important policy implications.

First, they demonstrate that literacy and numeracy test results are in fact connected to economically important, quantifiable outcomes — a point on which many education specialists have expressed doubt — and therefore underline the importance of producing publicly available indicators of student and school performance based on standardized skills tests. Such tests also improve school accountability. This suggests a role for explicit incentive mechanisms for teachers and school administrators based on these educational output measures.

Second, raising the skills level of people who have left the school system should not be neglected. Policy incentives for job-related training and lifelong learning, particularly measures targeted at people with very low skills, would likely generate substantial economic rewards.

Finally, in the context of a rapidly aging population, attracting skilled immigrants to Canada will become increasingly important.

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Most observers view Canada as a country that has a good education system with a high level of public funding. However, its performance in generating a skilled labour force does not stand out among the 30 member countries of the Organisation for Economic Co-operation and Development (OECD). As well, results from the International Adult Literacy Survey (IALS), conducted between 1994 and 1998, place Canada in the middle of the pack in terms of literacy scores among a group of 20 countries.[1] The IALS defines literacy skills as "the ability to understand and employ printed information in daily activities, at home, at work and in the community, to achieve one's goals, and to develop one's knowledge and potential". The survey tested these skills for individuals between 16 and 65 years of age over three broad areas — prose literacy, document literacy and quantitative literacy. It sampled everyday job tasks, ranging from simple to highly complex and thought to be closely associated with labour productivity.

Canada ranked respectively 5th, 8th and 9th on the prose, document and quantitative literacy scales (OECD 2000). However, many of the countries located at the lower end of the sample are significantly less developed economically than Canada. They include Chile, the Czech Republic, Hungary, Poland, Portugal and Slovenia. Canada does not perform well when compared to countries at a similar level of development. Perhaps more worrisome is the fact that, when looking only at less-educated individuals, those who have not completed upper secondary school, Canada ranks respectively 13th, 14th and 14th in prose, document and quantitative skills. As well, among individuals aged 16-to-25 who have completed secondary education, Canada ranks 8th, 8th and 13th in prose, document and quantitative skills, indicating that the Canadian schooling system is not doing well at providing young people with the skills required to perform well in the labour market.

Currently, most discussion focuses on the role of post-secondary education in providing highly skilled workers for the knowledge economy as a means of ensuring international competitiveness. However, our recent research (Coulombe, Tremblay and Marchand 2004) reminds us of the equal, if not greater, importance of increasing the general level of literacy and numeracy skills among young people, to some extent the purview of primary and secondary schools. The research — novel because it is based on direct measures of skills, rather than the usual crude proxies that use educational attainment — strongly suggests that there are potentially large pay-offs from investment in these less-glamorous sectors, or at least in what should be some of their core activities. The pay-offs come in the form of increased economic growth, which benefits society as a whole. They force

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1 These countries are Australia, Belgium (Flanders), Canada, Chile, Czech Republic, Denmark, Finland, Germany, Hungary, Ireland, Netherlands, New Zealand, Norway, Poland, Portugal, Slovenia, Sweden, Switzerland, United Kingdom and the United States.

us to rethink federal and provincial priorities in the area of the provision of human capital.

In light of Canada's performance in skills accumulation and of recent evidence on the macro-economic returns from raising the general skills level, we argue that Canadian governments may not be investing enough in literacy and numeracy skills and that this may have substantial adverse effects on economic growth and on the long-run standards of living of Canadians. As a result, governments should adopt a comprehensive skills strategy, one that would exploit the different channels through which economies accumulate skills, not the least of which would be to concentrate more resources on raising the competencies of people at the bottom of the skills spectrum and targeting skills acquisition and upgrading for workers.

The Elusive Link Between Skills and Economic Growth

There is little doubt that better-educated individuals have, on average, more rewarding jobs and higher incomes. Common sense also dictates that better educated societies are wealthier. Empirical researchers in economics have long devoted substantial efforts to estimating the individual and the social returns of education. Following a long tradition established by Mincer (1974), labour economists have been able to estimate a clear positive individual return from the statistical relationship between years of schooling and wages at the individual level. The estimated effect of one extra year of schooling on individual wages varies among countries and across time, estimated at 5 percent-to-15 percent.

However, empirical researchers have been less successful in their efforts to link various indicators of educational achievement at the country level to aggregate measures of welfare, such as the productivity level or per capita income. Somewhat paradoxically, in the last two decades or so, empirical macro-economists have not been able to clearly identify a positive gain from education in developed countries. Some commentators argue that small macro-economic returns may indicate that education improves the labour market performance of individuals and provides a signal of high ability to potential employers, rather than making them more productive. This theory, first advanced by Spence in 1973, indicates that education is essentially a sorting device, rather than one that provide skills that have a significant effect on productivity.

This debate raises an important economic policy issue related to the role of government in financing the education system. If the hypothesis is correct, government support for education would not be defensible from an economic efficiency point of view. On efficiency grounds, government intervention can only be justified by the presence of external benefits from education or by existing market imperfections in education investments. Because the existence and size of external social benefits and market failures are difficult to test empirically, the case for government support of education rests critically on the macro-economic estimates of aggregate returns from education. Our recent study (Coulombe, Tremblay and Marchand 2004) provides exactly that kind of evidence. Our results show that the returns from investment in skills in the form of enhanced economic growth are, in fact, substantial and may be highly beneficial to society as a whole.

The intense fiscal pressures faced by governments in the 1990s, combined with increased public support for health care spending, have led to decreased government support of education. At the same time, education policy debates in recent years have mainly focused on the post-secondary level, with topics ranging from tuition to boosting the number of graduate students. While the need to improve health care systems in Canada appears indisputable, compromising investment in skills acquisitions is unlikely to be a wise solution. A more balanced approach to the allocation of scarce public funds between health care and education would appear more appropriate, especially in light of the fact that investment in education will ultimately determine our capacity to generate wealth and to provide better health care. And while education should be the cornerstone of our skills strategy, the role of education in generating skills has to be complemented by adult training and immigration. That is especially so because demographic trends in the next few decades will limit the contribution of initial education to overall skills accumulation.

Before summarizing our recent results on the macro-economic returns from skills accumulation and discussing the potential policy implications of our results, we briefly explore the potential efficiency rationale for government policies to promote the acquisition of skills.

The Rationale for Policy Intervention in Skills Investment

The desire to increase the productive capacity of individuals does not, by itself, justify public spending on skills investment. Any desirable government intervention has to be grounded in the presumption that private markets are, for a variety of reasons, not leading to the appropriate level of investment in skills. There are, however, numerous rationales for public investment in skills.

For example, there are well-known imperfections in credit markets that prevent liquidity-constrained individuals from investing in this area. These imperfections arise essentially because human capital can rarely be used as collateral on loans, even when the expected return from education is substantially above the return on other types of investment. Therefore, public funding is usually seen as critical in broadening access to education and ensuring equality of opportunity for all, regardless of family background.

Even in the absence of credit market failures, decisions to invest in education, or to acquire skills through different forms of training, are generally not taken efficiently if left solely to the private market. For one thing, the investment is particularly efficient when people are in their childhood. The opportunity cost of studying is smaller for young people and they can benefit from their investment over a longer period of their lifetime. However, the decision to invest in the education of young people is typically taken by parents, whose interests may not be aligned with those of their children. Generally speaking, such investment relies heavily on some form of altruism, and the lack of sufficient altruism, combined with the desire to insure equality of opportunity may, in fact, be an important rationale for making basic education mandatory.

Second, the skills of an individual often generate external benefits of various natures for other individuals or for society in general. For example, highly skilled

individuals may have a positive effect on innovation and technological progress, and may not be able to capture these benefits entirely in the form of higher wages or higher entrepreneurial income. In this case, if those individuals support the entire costs of acquiring skills, while sharing the benefits, they will tend to under-invest from society's perspective.

There may also be external effects if education contributes to the formation of social capital, if it reduces crime, or if it promotes political and civic participation. Education may also have positive effects on an individual's health, on fertility decisions and on transfers of human capital to children. To the extent that individuals do not take into account the full value of these benefits when making investment decisions in education, then their levels of investment will tend to be too low from society's perspective. In order to correctly align individual incentives to invest with the full social benefits of education, governments may be justified in lowering the private costs of education through public funding.

However, the magnitude of external beneficial effects arising from education is largely unknown (see, for example, McMahon 1999 and Davies 2003), which can cast doubt on the desirability of sustaining high levels of public funding. In principle, in order to determine the appropriate level of public funding, it is necessary to compare the private and social returns from education, not easily done in practice. Aside from equity considerations, public funding is only justified if the social returns from human capital are larger than private returns. In fact, if education raises peoples' earnings because it provides a signal of ability to the labour market (Spence 1973), the private return from education may be larger than the social return and that, in principle, would justify policies that discourage public investment, at least from an efficiency perspective.

Because comparing the private and social returns is difficult, the case for public funding rests on the aggregate social gains of human capital estimated in the macro-economic growth literature. Although finding high macro-economic gains from human capital does not provide direct evidence of human capital externalities or failures of private markets, it does indicate that the social gains of education are substantial, reinforcing the view that policy intervention to promote investment in skills enhances efficiency.

Literacy Skills and Growth Among OECD Countries

Over the last two decades or so, several studies have found human capital to be positively associated with growth in broad sets of countries (Barro 2001). However, in studies where the analysis is restricted to developed countries only, human capital is generally not found to have a significant effect on growth (Islam 1995; Barro 2001).

A potential explanation for this puzzling result is that the schooling data typically used may be a poor proxy for the productive human capital of an economy. Schooling indicators are indirect measures of the skills that individuals possess and are likely to suffer from serious comparability problems among countries over time. Alternatively, the finding may be valid: Human capital may not, in fact, be a key determinant of the relative well-being of developed economies.

Obviously the explanation matters a great deal for public policy. If there are no clear macro-economic gains from investment in human capital, public funding of education may be difficult to justify, at least from an efficiency perspective. In this case, it may be more appropriate to promote growth with policies that encourage research and development or induce the formation of social capital, for example.

Our recent research (Coulombe, Tremblay and Marchand 2004) re-examines the effect of human capital accumulation on the growth of developed countries by using output indicators of human capital based on test scores from the International Adult Literacy Survey. Our reference to output, rather than input indicators, refers to the economic concept of the production function. Suppose that H, human capital, is produced by the combination of two types of components: the number of years spent in the educational system (schooling) S and an index Q that capture the quality of the educational system In this production function, F is the technology that combines the two inputs:

$$H = F(S,Q,...)$$

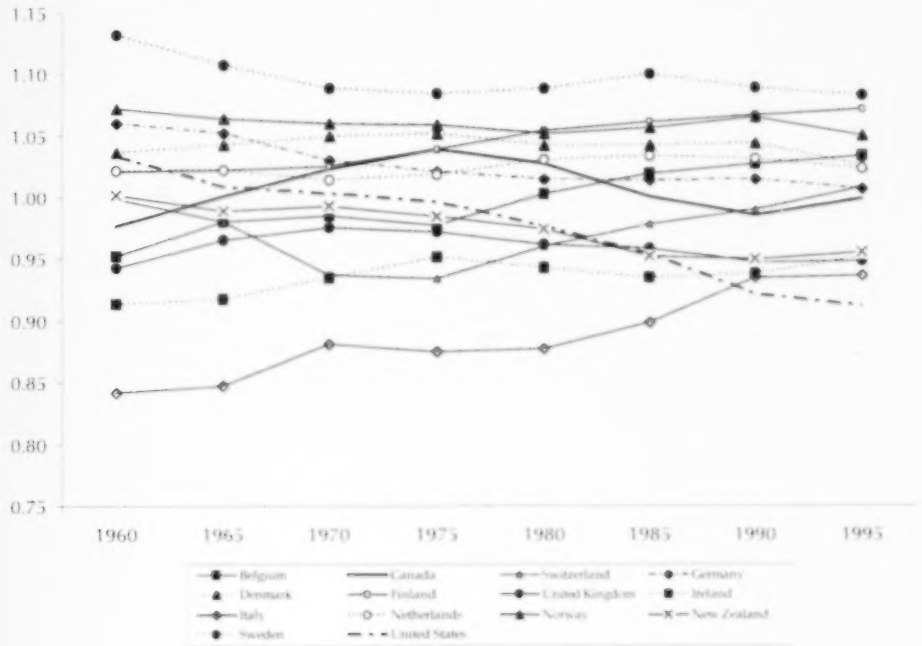
In micro-econometric labour studies where the general purpose is to explain wage differentials among individuals within a country, the relative homogeneity of the educational system across various regions of a country implies that S may be viewed as a good proxy for H. In macro-econometric, cross-country studies, however, Q and F are likely to differ substantially among countries. Furthermore, cross-country studies usually pertain to a long time interval to capture the dynamics of capital accumulation in the growth process. Consequently, measuring the output H by an input S might not be adequate because Q and F are likely to vary among countries and over time. Our approach, based on skills, may be preferable in macro studies because skills are a direct measure of the output H.

Our output indicators of human capital were found to contain substantially more information about the relative long-run growth of developed countries than did the input indicators, based on schooling data typically used in estimating the macro-economic gains from education. Using these output indicators of human capital, our analysis shows that skills accumulation actually matters a great deal to the long-run economic growth and relative well-being of developed countries. In doing so, our findings contribute to the reconciliation of empirical evidence with economic intuition on the macro-economic benefits of education. In the next section, we review the main results from this research, focusing on those that seem particularly important for public policies in Canada.

Literacy Scores and Past Investment in Skills

Indicators of literacy are not yet available over long periods of time. As a result, to exploit the information about the long-run relative growth of countries contained in a single cross-sectional observation of literacy proficiency, we have derived synthetic time series of human capital for 1960-to-1995 from the demographic profile of test scores. We used the literacy results of individuals that, according to the demographic structure, would have been aged 17-to-25 in a particular period as proxies for the relative human capital investment of countries in this period. For

Figure 1: *Average Literacy Score of Population Aged 17-25 Relative to the Cross-Section Mean*



example, individuals that were aged 17-to-25 in 1990 were 21-to-29 when the survey was conducted in 1994, and so on. The data were available for 14 countries[2] and were broken down by gender groups.

In contrast to the input indicators of human capital based on schooling enrolment and attainment, these indicators provide an output measure of the quality of human capital and are not subject to the usual problems related to the comparability of education systems among countries over time. At the micro-economic level, the skills measured by IALS also explain a substantial part of wage earnings independently of the effect of education (Green and Riddell 2001). Therefore, they are likely to contain more information about the relative growth of countries than schooling data.

It should be noted that the tests do not measure only basic literacy and numeracy skills. The tasks are designed to assess skills divided into five broad levels. For example, according to OECD and Statistics Canada (2000), tasks at level 5 may require respondents to "search for information in dense text that contains a number of plausible distractors", to "make high-level inferences or to use specialized knowledge", to "process conditional information" and to "perform multiple operations sequentially". Only 20 percent, 19 percent and 31 percent of the Canadian respondents who were aged 17-to-25 years in 1995 succeeded on the level 4 items in the prose, quantitative and document literacy domains,

2 These countries are Belgium (Flanders), Canada, Denmark, Finland, Germany, Ireland, Italy, Netherlands, Norway, New Zealand, Sweden, Switzerland, United Kingdom and the United States.

respectively. For level 5 items, these percentages are respectively 1 percent, 1 percent and 4 percent. This indicates that these tests measure certain skills that are not usually acquired prior to post-secondary education.

The construction of the synthetic time series from the cross-section data cannot take account of migration flows over the period, and that is an important drawback to our indicators. They also impute levels of literacy to individuals at earlier ages, without correcting for the adjustment in the quality of human capital that occurs during a lifetime through learning and human capital depreciation. This is a potential disadvantage of our indicators relative to schooling data. If individuals' human capital tends to grow during post-school life, our indicators might tend to overestimate the human capital investment made before individuals entered the labour market. However, our empirical strategy, based on the organization of data in the temporal and the cross-country dimensions, enables us to partly overcome these difficulties. All common time trend effects (among countries) and country-specific time-invariant effects are erased from the analysis.

Average literacy scores of the population aged 17-to-25 relative to the cross-section mean are depicted in Figure 1. Scandinavian countries are performing relatively well. Sweden had the highest average score throughout the period and Finland improved from 6th to 2nd place. Italy, which had the lowest score in 1960, improved substantially from 84 percent of the average to 94 percent in 1995. In contrast, the United States recorded the largest decline from 103 percent of the average to 91 percent, going from 5th to last place. The indicator for Canada is hump-shaped reaching a maximum in 1975.

An Empirical Analysis of Cross-Country Growth

The purpose of the empirical analysis was to estimate the effect of investment in skills on the relative growth of countries in the 1960-to-1995 period. To this end, we employ the conventional convergence-growth framework, where the growth rate of per capita gross domestic product (GDP) and labour productivity are regressed on a set of explanatory variables. Those include the initial level of GDP per capita, or labour productivity (convergence hypothesis), human capital indicators, the investment rate, the fertility rate and the openness ratio, measured as the ratio of exports plus imports over GDP filtered from the effect of population and geographic size.

There are other variables that may affect aggregate production and that have proven successful in explaining long-run, cross-country differences in studies looking at a group of countries, including developed and less-developed ones. Examples of such variables include inflation, the share of government spending on GDP, measures of political stability and of the quality of the legal system. However, as shown in Barro (2001), these other variables do not have a significant effect on growth when the sample is restricted to OECD countries. As a result, we did not include any of these variables in our analysis.

Because of the small number of countries included in the sample (14 for per capita GDP regressions and 13 for labour productivity) and because we want to take into account the historical evolution contained in our synthetic literacy data bank, our growth regressions are performed following a panel data approach that

combines times series and cross-country data. However, the combination of time series and cross-sectional information in growth regressions had to be done very carefully since the two types of information are not comparable in a straightforward manner.

First, common trends and common shocks, such as the productivity slowdown or the oil shock, were extracted from the time series observations in order to obtain unbiased results. Our methodology has also corrected for common comparability problems through time in the literacy data. For example, part of the variability of literacy scores across the synthetic cohorts might be associated with work experience and aging. Second, we have controlled for time invariant heterogeneity across countries that could result, among other things, from differences in the quality of the literacy data among countries, perhaps associated with differences in population coverage. More details on the empirical methodology are available in Coulombe, Tremblay and Marchand (2004).

The Impact of Skill Investment on GDP Growth

We derived three broad sets of results from our empirical analysis, based respectively on human capital indicators constructed from the average literacy scores of the population, from the distribution of the population over different levels of literacy and from the average literacy scores of men and women.

First, we used the average literacy scores in each country, as well as the three sub-tests on prose, quantitative, and document skills, and found that the estimated effect of these human capital indicators on the growth of both per capita GDP and labour productivity is positive and highly significant in all cases. Interestingly, the quantitative effect of human capital is very similar across the four different measures (prose, document, quantitative and average tests score), which indicates that the amount of information related to future growth embedded in the three specific types of literacy tests is very comparable.

Quantitatively, our estimates indicate that a country which is able to improve its mean literacy score by 1 percent relative to other countries will be able to achieve a higher relative per capita GDP by 1.5 percent in the long run. Interestingly, the effects of literacy skills on labour productivity are greater than the effect on GDP per capita. In the case of labour productivity, a 1 percent increase in the literacy measure in a country will generate in the long run an increase in labour productivity above 2 percent. This finding not only illustrates the robustness of the relationship between human capital and growth, it also shows that the effect of the literacy variable on living standards is not driven by labour market effects. If the effect of literacy on growth were only significant for per capita GDP, it could be argued that the effect of human capital investment on living standards is mainly driven by its effect on unemployment and participation rates. But we found the effect of human capital to be more substantial on labour productivity. This indicates that the primary effect of human capital investment on living standards comes from its role in the broad capital accumulation process, as predicted by the theoretical framework underlying our analysis.

Our methodology also enabled us to compute estimates of the incremental contribution of physical and human capital to increases in national income. The

implied measure for the share of physical capital is found to be around 0.24 in all cases. This number is quite close to the observed share of profits in national income of developed countries, which is typically around 30 per cent and fairly constant over time. The implicit share of human capital is around 0.46. These numbers leave about 30 percent of national income for the retribution of raw labour, which implies that two-fifths of wages correspond to the retribution of raw labour and three-fifths represent the returns to skills.

Regarding the other variables included in the analysis, the initial level of per capita GDP and labour productivity is always found to have a negative effect on subsequent growth, indicating that countries that were relatively poor initially tend to grow faster over the period. The effect of the investment ratio is positive and highly significant in all cases. The fertility rate is usually not highly significant in most regressions but has the expected negative sign. Finally the openness ratio is found to have a positive and highly significant effect on the growth of GDP per capita and labour productivity.

Secondly, in order to compare the relative contribution to growth of investment in the human capital of men and women, we analyzed the growth of GDP per capita and of labour productivity, using the separate average literacy scores of men and women as human capital investment measures. In order to control for the effect of women's literacy on their labour market participation, we also included, as an additional explanatory variable, the participation rate of women relative to that of men.

Undoubtedly, investment in the human capital of women appears to have a much stronger effect on subsequent growth than investment in the human capital of men. For both GDP per capita and GDP per worker, and all four measures of human capital investment, the quantitative effects are always larger and more statistically significant for the literacy levels of women. As well, in the case of men's literacy, document skills seem to be less important than prose and quantitative skills. In the case of women's literacy, prose skills have the largest impact on GDP per capita, while quantitative skills seem to be relatively more important for productivity.

Finally, we explored how the distribution of skills affects economic growth. In addition to average scores, survey results are also available as percentages of individuals who have attained literacy levels of 1-to-5 thought to be associated with particular sets of skills. We used these measures as indicators of human capital investment and found, for the three types of tests, that the percentages of individuals who attained at least level 4 in a country have a positive effect on growth, though this effect is only statistically significant for the indicator based on prose skills. These results indicate that measures based on the average test scores over all individuals are better indicators of the aggregate level of human capital investment than measures based on the proportion of individuals who achieved relatively high levels of literacy.

We also estimated how the share of individuals who achieved only level 1 affected growth. Such a measure may be seen as an indicator of under-investment in human capital, which may act as a drag on growth. Results indicate that the percentage of individuals achieving level 1 only in the prose skills of the population, and in all three types of literacy skills of men, had a negative and

significant effect on the growth of GDP per capita. For per worker GDP, the document skills of men and the prose skills of women were found to have a negative and significant effect on growth.

Although the results regarding the distribution of skills are not as robust as those regarding the mean level of literacy, the findings generally imply that the distribution of human capital investment may be important for long-run standards of living. In particular, it is consistent with the view that human capital investment fosters growth mostly by making the overall labour force more productive, as opposed to developing highly talented individuals who may, among other things, have a positive impact on growth through their contribution to innovation and technological progress.

Policy implications for Canada

Our results generally point to the importance of accumulating skills. Doing so appears to be critical for the future economic growth and well-being of countries. The immediate issue is how Canadian governments can promote the acquisition of skills. We examine five areas where they could play an increasingly important role in the future.

Increasing the Accumulation of Skills Produced Through Formal Education

While increasing resources in the education system would undoubtedly improve outcomes to some extent, it is not clear that it would be the most cost-effective strategy to generate more skills. In fact, there is evidence that particular policies geared at altering the incentive structure within the schooling system may actually have a greater impact on students' performance than input-based policies (Hanushek 2003). This may especially be the case at the elementary and secondary levels where spending per student has actually increased in Canada in recent years because of lower enrolment (Guillemette 2005).[3]

Governments may be able to help create stronger incentives for better outcomes in the schooling system by producing publicly available indicators of student and school performance based on standardized tests of acquired skills. Such an approach would be in line with one of the main results of our analysis which is that output measures are more appropriate than input measures, especially when comparing a variety of educational systems. The existence of such indicators would likely improve accountability in the schooling system independently of whether any explicit incentive mechanisms based on these indicators are implemented.

3 However, according to the Report of the Pan-Canadian Education Indicators Program (Statistics Canada and Council of Ministers of Education of Canada 2003), between 1995 and 2001, total education expenditures of all governments combined have actually decreased in real terms from $64.6 billion to $62.8 billion, while school-age population (ages 5-to-24) increased by approximately 3 percent between 1996 and 2001.

Inducing higher competition among schools by allowing a higher degree of school choice for parents and producing school rankings based on student achievement are other measures that could be used more widely to introduce stronger incentives for good performance within the schooling system. In fact, recent evidence in the U.S. indicates that increased school choice leads to higher school quality (Hoxby 2000, Holmes, DeSimone and Rupp 2003).

Policies aimed at improving teacher quality may also produce greater skill gains by students. Recent evidence indicates that the effect of teacher quality on student performance is substantial, actually much larger than other factors, such as class size, and that it can even make up for the large negative effects of a disadvantaged family background (Hanushek 2003). Such evidence indicates that improving teacher training and providing them with stronger performance incentives would likely generate significant benefits. For example, merit pay tied to student performance, whether on an individual teacher or school basis, should be considered.

While spending per student at the elementary and secondary levels has increased in recent years, there have been cutbacks at the post-secondary level. According to the Report of the Pan-Canadian Education Indicators Program (Statistics Canada and Council of Ministers of Education of Canada 2003), between 1990/1991 and 2001/2002, average university undergraduate tuition fees in Canada have increased by 99 percent, climbing to $3,585 from $1,806 in constant 2001 dollars. There has been a 138 percent increase at the graduate level.

Although it is unclear whether the current level of tuition is above or below what may be considered optimal, such increases do raise concern about the accessibility of university education. Partly as a result of the increases, the share of university and university-college revenue from government sources decreased to 55 percent from 68 percent between 1990/1991 and 1999/2000. As well, the number of teaching faculty in Canadian universities decreased to 33,801 from 35,917 between 1989/1990 and 1999/2000, while the number of full-time students increased to 580,376 from 499,520 between 1988/1989 and 1998/1999.

Although increasing spending at the post-secondary level would not necessarily be the most effective way to produce more skills, the decline in government support for post-secondary education observed in recent years is cause for concern, especially in light of our recent results on the macro-economic returns from skills.

Less government support for post-secondary education may be the result of the fiscal pressure that most provincial governments faced in the 1990s, combined with large increases in spending on health care. In addition to population aging and the rising costs of health care technologies, which have further increased the overall cost of heath care, the baby-boom generation now entering retirement age may have tilted the political process away from education. Indeed, as a percentage of total government program expenditure, the share of education decreased to 14.8 percent from 15.5 percent between 1995 and 2001, while the share of health expenditures increased to 17.2 percent from 13.8 percent (*Report of the Pan-Canadian Education Indicators Program 2003*). Allocating a relatively larger share of public funds to public consumption, as opposed to public investment, could have deleterious long-run effects.

In addition to these developments, while most provincial governments were struggling with problems of fiscal imbalances, Ottawa slashed federal transfers to provinces, which are intended in large part for the financing of education, health care and social assistance, in the second half of the 1990's. Indeed, between 1995/1996 and 1999/2000, federal cash transfers to provinces decreased to $27.1 billion from $29.5 billion. As a percentage of total program expenditures, this represents a decrease to 17.3 percent from 21.2 percent. Although transfers were subsequently increased to $34 billion, or 18.8 percent, of provincial program expenditures by 2002/2003, transfer reductions likely explain part of the decreasing provincial government support for post-secondary education.

The role of the federal government is especially important in financing education, because inter-provincial migration generally induces provincial governments to under-invest in education. Inter-provincial migration implies that part of the skills produced from the investment of provincial governments in education benefit other provinces, leading the governments to under-estimate the full return on education. As a result, in the absence of significant federal funding, education expenditures will tend to be too low, especially at the university level, because university graduates are the more mobile. Moreover, because the typical inter-provincial migrants are better educated than the non-migrants, the migration pattern from the poor to the rich provinces tends to increase provincial disparities (Coulombe 2003), and creates relatively larger disincentives to invest in education in poorer provinces.

One way to offset these incentives problems may be to introduce expenditure needs in the formula used to allocate federal transfers among provinces under the Canada Social Transfer (CST) program (Coulombe and Mérette 2000). The actual division formula of the CST is based on an equal entitlement per capita for all provinces. Devising an allocation formula linked to the provinces' efforts in providing post-secondary education, a formula based on university enrolment figures, for example, would tend to create stronger incentives to invest in education by provincial governments despite the increasing mobility of skilled individuals.

Promoting the Acquisition of Skills by Adults

In addition to providing skills to young individuals through education before they enter the labour market, it may be equally important to promote the acquisition of skills by adults that are already part of the labour force. This is especially true in the context of current demographic trends which will limit the contribution of initial education to overall skills accumulation in the future, and will therefore increase the importance of supplying skills through adult training. Lifelong learning is also increasingly important because of the speed of technological progress which rapidly creates new skill requirements in the labour market.

Canada's performance in the area of adult training could be improved. The IALS reveals that the participation rate in job-related, employer-supported training was only 27 percent in Canada in 1994, compared to 50 percent in Britain and 37 percent in the United States. As well, results from the Adult Education and Training Survey indicate that the percentage of the total adult population

(excluding those aged 17-to-24 enrolled full-time in a secondary or post-secondary program) participating in adult education and training has actually decreased between 1993 and 1997 to 27.7 percent from 30.3 percent. Low investment in adult training could eventually have a negative effect on the productivity growth of the Canadian economy and limit the ability of companies to adjust to technological change.

Although our empirical research has focused on the skill levels of labour market entrants, our results indicate that policy incentives for job-related training and lifelong learning would likely generate substantial economic rewards. A number of different policies are potentially available. However, the choice of policy instruments and the appropriate design of policy intervention are not obvious because of the complex nature of decisions to invest in training. Part of the complexity arises because there are many different types of barriers that prevent individuals and companies from optimally investing in training, in addition to the typical market failures that affect investment in human capital more generally, such as the credit market imperfections and knowledge and innovation spillovers that were discussed in Section 3.

For example, there are externalities related to training because of labour turnover, which prevents companies from capturing the entire benefits from investments in the general skills of their employees. There may also be contracting problems between companies and workers that will lead to sub-optimal investment in training. Since wages can be renegotiated after training has taken place, the benefits will typically be divided between employers and employees, regardless of whether the worker or the company has incurred the cost of training. Thus, the inability to commit to long-term employment contracts may lead to a form of hold-up problem implying that neither party can appropriate the entire return from a training investment. As a result, both companies and workers may have some incentives to support part of the cost of training, although both will tend to invest at sub-optimal levels if they anticipate the outcome of the bargaining process.

Because of the complex nature of training investments, a wide range of policy instruments to promote training have been used elsewhere and may be worth considering in Canada. For instance, the effective cost of training can be simply lowered through corporate tax deductions for training expenditures. Such a policy has been used in different forms in several OECD countries. For example, Austria, Italy and the Netherlands allow deductions of from 120 percent-to-150 percent of the cost of training arising from labour turnover. France provides a tax credit of 35 percent for the training expenditures that exceed those made in the previous year. Alternatively, the government can simply mandate a minimum level of training. For example, the governments of Quebec, as well as those of some countries, including France, have adopted laws requiring companies to spend a percentage of their payroll on training.

Pay-back clauses may be used to circumvent the under-investment problem that results from labour turnover. Pay-back clauses force employees who leave their employer to reimburse part of the cost of the training they received. These arrangements lower the incentives of workers to seek a new job after being trained to capture the return from their newly acquired skills and enable employers to

recoup more easily the cost of training investments. Pay-back clauses are used in a number of countries, including Austria, Germany, Italy, Netherlands, Norway and Switzerland.

While these policies are targeted at companies' incentives to train, there are also a number of ways to overcome the training barriers faced by workers. For example, individual learning accounts can mitigate credit market problems. The purpose of these accounts is to induce individuals to save to finance future training programs. The incentives of individuals to create such accounts should be strengthened by favorable tax treatment or by matching contributions from the employer or the government. Similarly, training-time accounts can be used to enable workers to accumulate time, through overtime hours for example, that can later be used to undertake training programs. These types of arrangements are widely used in a number of European countries, including the Netherlands, Denmark and Germany.

As well, the incentives of individuals to invest in their skills can be significantly improved by implementing certification systems that increase the recognition that training programs receive in the labour market, and that enable workers to capture the return from their investment more easily. The obvious drawback of certification systems is that they tend to lower companies' incentives to finance training programs by increasing the mobility of trained workers.

There are many types of policies that could be implemented in Canada to promote training, many of which have been tested in other countries. In light of Canada's relative performance in the area of job-related training, it is essential to identify the types of instruments that would be most appropriate within the structure and specific features of Canadian labour markets, and adopt a policy strategy that would create strong incentives for both companies and workers to substantially increase their investment in training.

Increasing Investment at the Lower End of the Skill Distribution

In addition to increasing the level of public support for education and lifelong learning, our results also suggest that targeting investment at the lower end of the skill distribution may be important. Indeed, our study has shown that the returns of human capital in terms of higher economic growth are more sensitive to the average skills of the entire population, as opposed to the share of individuals who acquire high levels of skills, and that the proportion of individuals who have very low levels of literacy act as a drag on growth.

As a result, it is critical to ensure that nearly all young individuals acquire basic skills before entering the labour market. According to the Youth in Transition Survey conducted by Statistics Canada in 1999, 12 percent of 20-year-old Canadians had not completed high school and were no longer in school. Although this percentage has been on a downward trend during the 1990's, the numbers remain sizeable. Therefore, devoting more education resources to increasing graduation rates at the secondary level could be highly important for economic growth. However, this objective should not be reached at the expense of decreasing educational standards. One of the main results from our empirical analysis is that skills matter more than years of schooling. As well, making welfare

and employment insurance programs more conducive to completing high school education may also be useful policy measures for increasing graduation rates and skills acquisition.

By the same token, it may be desirable to target the policy measures for adult training towards low-skilled individuals, who tend to receive little employer support for training. In fact, according to the IALS, only 16 percent of individuals aged 16-to-65 who did not achieve upper-secondary education participated in employer-supported training in 1994. Increasing resources in government training programs for the unemployed would also be highly beneficial because individuals, especially unemployed individuals, can hardly finance training investments themselves.

Attracting Skilled Immigrants

Our results indicate that the accumulation of skills from any source is a key driver of economic growth. Immigration is an important source of new skills and will likely have a positive effect on growth, just as education and training do. Immigration policy should be viewed as a key component of public policies for skills accumulation. In fact, because of the demographic trends facing Canada, it actually seems critical to complement education and adult training by attracting skilled immigrants.

Moreover, immigration may be a more cost-effective strategy for building the stock of skills of the Canadian economy than even education and training, and can be fairly easily tailored to specific skills needs it admits yearly and possibly increase the importance of skills relative to other attributes in the selection of immigrants.

Because of the increased international mobility of highly skilled workers and the potential contribution of these individuals to economic growth, making Canada a destination of choice for potential migrants would be beneficial, although it is unclear how such an objective might be achieved. Perhaps fiscal measures targeted at highly skilled immigrants in specific key sectors should not be excluded. For example, fiscal incentives are currently used by the Quebec government, which offers income tax breaks to foreign university professors who are joining faculties of the province's universities.

Investing in the Skills of Groups That had Poor Access to Education in the Past

Our empirical analysis indicated that investing in women's literacy was much more important for growth than was the case with men. Different explanations could potentially account for this finding. First, to the extent that there were initially social barriers to the education of women in the period that we studied, investment in the literacy of women may have been provided to relatively high-ability individuals. The more able women were more likely to overcome barriers to education and labour market participation. Thus, human capital would have

been combined with individuals of higher innate potential on average in the case of women.

Second, the rate of return on women's human capital investment may have been high because the initial level of literacy was relatively low among women. Because of diminishing returns to the accumulation of human capital, the increase in the productivity of labour that results from an increase in human capital is higher for groups of individuals with low initial levels of human capital. So, provided that there were barriers to women's education, investment in women's literacy may have had a greater impact on GDP. Obviously, the incentives of women to acquire skills depend to a large extent on their ability to participate in the labour market. As a result, policies that facilitate the labour market participation of women, such as public subsidies for child care, for example, may be an important component of a comprehensive skills strategy.

The differential effect on the productivity of women and men could also be explained by the fact that women's literacy may capture the effects of variables omitted from our analysis, such as the level of social infrastructure (Hall and Jones 1999) and social development of a country.

In any case, the fact that women's literacy is found to have a much stronger impact on growth than that of men indicates that investing in the skills of particular groups of individuals that may have had a poor access to education in the past, such as the Aboriginal population, may have a significant impact on economic growth, whether it does by having a substantial effect on productivity or by stimulating the formation of social capital. Consequently, it may be desirable to implement policies that target the incentives of such groups to acquire human capital.

Data from the 2001 Census indicates that among the Canadian Aboriginal population aged 25-to-64 years, 39 percent had not completed high school, while only 8 percent had a university degree. Moreover, among the 20-to-24 year olds, only 24 percent of the Aboriginal people were attending school on a full-time basis, compared to 40 percent for the non-Aboriginal population. School attainment and enrolment are even lower for Aboriginals living on reserves, where responsibility for the education system rests with the federal government. Our results lead us to believe that increasing investment in the education of Aboriginals would not only substantially improve their communities, but would also likely bring significant economic gains to Canada as a whole.

Conclusion

While investment in skills is found to be a key driver of the relative economic growth of countries, Canada is not doing particularly well compared to other OECD countries in skills accumulation. In our view, addressing this issue should be of major concern to Canadian policymakers.

In the 1990s, Canadian governments went through a period of severe fiscal constraint to balance budgets and reduce the debt burden. Public spending on education, at the post-secondary level at least, has suffered in the process of restoring fiscal balance. However, since the late 1990s, the fiscal position of various governments, particularly the federal government, has been continually

improving. A steady decrease in the debt-to-GDP ratio has gradually generated manoeuvring room. However, as a result of the actual rigidities in the health care system in Canada and the aging of the population, there has been increased demand for spending in that area.

In our view, the best way to ensure better public services, including health care, is for Canadians to become richer. And one of the best ways of achieving that is to strengthen public financing of education. The first step could be to redesign the division formula for the Canadian Social Transfer to induce stronger support for post-secondary education spending by provincial governments. An alternative would be to base the division formula on a measure of post-secondary enrolment.

As well, a series of measures should be implemented to create stronger performance incentives, competition and accountability within the education system, especially at the elementary and secondary levels. Specific measures could include producing publicly accessible data on student and school performance based on standardized tests, increasing the degree of school choice for parents, and introducing explicit incentives for the compensation of teachers based on comparable measures of student achievement.

In addition to education, an economy can accumulate skills through job-related training and lifelong learning, as well as through immigration. Because of the rapid pace of technological change, skill requirements in the labour market are changing rapidly, increasing the importance of training adult workers. Numerous policy measures are potentially available to promote skills investment by companies and workers. However, very few policy incentives in this area have been implemented in Canada. Low investment in adult training may eventually limit the capacity of the Canadian economy to adjust to technological change and to deal with population aging. As a result, it is imperative to identify the appropriate policy instruments to promote training because of the structure of Canadian labour markets and the particular barriers faced by companies and workers. Also, the role of immigration as a source of new skills appears increasingly important. Raising the importance of skills in the process of selecting immigrants should be part of a comprehensive skills strategy.

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